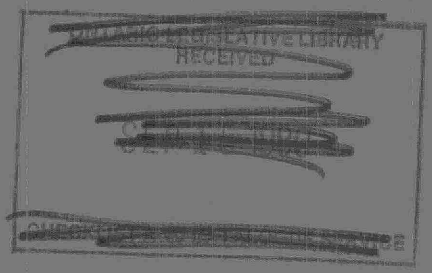
TOWNSHIP OF PAKENHAM

A MUNICIPAL SURVEY OF THE COMMUNITY OF PAKENHAM

1977



Ontario
Ministry of the Environment

TOWNSHIP OF PAKENHAM

A MUNICIPAL SURVEY

OF THE

COMMUNITY OF PAKENHAM

MUNICIPAL & PRIVATE ABATEMENT SECTION

SOUTH EASTERN REGION

1977

TOWNSHIP OF PAKENHAM

A MUNICIPAL SURVEY

OF THE

COMMUNITY OF PAKENHAM

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TOWNSHIP OF PAKENHAM

Municipal Survey

Introduction

The purpose of this report is to provide a description of the ground and surface water conditions in the Community of Pakenham. A total of five studies were made of the groundwater conditions. The initial two studies were performed in 1962, another in 1967, one in 1969 and the most recent in 1976. Surface water surveys in the community were undertaken in 1968, 1970, 1972, 1976 and 1977. With the exception of a well survey performed in 1976, the sampling of the groundwater was exclusively bacteriological. In 1976, both chemical and bacteriological samples were collected and it is for that reason the results from the 1976 survey are dealt with in greater detail in this report.

The assistance and information received from the following persons and organizations is gratefully acknowledged:
Mr. H. Brodmann - Clerk, Township of Pakenham
Mr. J. Craig - Leeds, Grenville & Lanark District Health Unit.

Location and Description

The Community of Pakenham, population 350, is located approximately twelve miles north of the Town of Almonte on Highway 29. The major employer is an electronics firm, Nor-Pak Limited, employing 20-22 local residents. There are no "wet" industries in the community. A public school is located in the centre of the village and has a student enrolment of 220.

Topography & Soils

All natural drainage is directed to the Mississippi River, which flows along the eastern perimeter of the community. Two soil types are present within the confines of the village; the Almonte series and North Gower clay loam series. The soils of

Topography & Soils Cont'd.

the Almonte series are moderately fine textured, developed on water-laid deposits of calcareous, silty clay loam. These soils are well drained although the movement of moisture through the soil is only moderate because of the fineness of the soil particles. The North Gower clay loam contains little other than the two components mentioned in its name. They occur in depressions between knolls and are formed of calcareous clay loam and clay material. Because of their location, they receive the water runoff from the adjacent slopes and usually have a high water table.

The topography is generally flat or slightly sloping to the river. The ridge of the river valley runs in a northwesterly direction through this village. The slope of this ridge varies from 10% to 60% with steeper slopes in the north-eastern portion of the community.

Existing Services

At present the residents rely on individual water supplies and sewage disposal systems.

Groundwater supplies are generally obtained from the limestone bedrock in this area. Water found in this type of aquifer is encountered at various depths, but usually less than 50 feet. Certain areas in the community are also subject to groundwater chemical quality problems, e.g. hydrogen sulphide gas and/or salt. A review of the "Water Well Records for Ontario" indicates that "fresh" water was found at depths of 0-feet "flowing", to 30 feet. Flow rates were reported to be on the average of 10 gallons per minute (gpm).

There are approximately 80 to 90 subsurface sewage disposal systems in use in the Community of Pakenham. A 1968 Health Unit survey of this area gave the breakdown on the types of systems as follows:

Existing Services Cont'd.

septic tanks	80
privies	9
chemical toilets	2

This report, based on the aforementioned survey, also stated that there were no serious problems with the septic tanks. However, the results from all the surface water surveys would seem to indicate that the storm sewers are being contaminated with human sewage. A subsequent dye-testing survey revealed that approximately 15% of all the homes on the main street were discharging directly into the storm sewers, and that the remaining homes were probably serviced by older and possibly malfunctioning systems. It was concluded by the Health Unit that individual correction of the sewage disposal systems would be difficult and probably result in no overall improvement.

Well Survey (1976)

Sampling Procedure

On June 22, 1976 an attempt was made to secure a bacteriological sample from every well in the village and a chemical sample from every second or third residence. A total of fifty-nine (59) bacteriological and thirty-one (31) chemical samples were collected during the survey. These figures represent approximately sixty percent of the wells in the community. (Residences inspected during the survey are shown on the appended map).

Bacteriological Results

The main reason for bacteriological testing was to determine if pathogenic bacteria were present in the well water. The presence of certain coliforms, as revealed by this test, indicate fecal contamination, and thus the possible presence of pathogenic[1.] bacteria. Three standard groups of indicator organisms are total and fecal coliforms and fecal streptococcus.

1. disease causing

Well Survey (1976) Cont'd.

Bacteriological Results Cont'd.

Total coliforms are of soil, vegetation and/or fecal origin, whereas fecal coliforms and fecal streptococcus can only be associated with human or animal fecal matter.

Discussion of Bacteriological Results

A review of the bacteriological results (Table One) indicates that the bacteriological groundwater quality has been improving steadily since 1962. The results of the latest survey (1976) would seem to indicate that this trend has reversed. However, if the survey times are compared, only the 1976 survey was performed during the summer months. The effects of colder temperatures, and more specifically frozen ground, in relation to the degree of well contamination have not been fully researched. It would seem reasonable to assume that the amount of leachate from septic tanks and the surface water infiltration to the wells would be reduced during the winter. All previous surveys were done during the winter months, thus providing a possible explanation for the increased number of contaminated wells found during the 1976 survey. Although the previous surveys did not examine samples for fecal streptococci, the results (see Appendix 1) from the 1976 survey show that twelve (12) of the nineteen (19) adverse tests have fecal streptococci present. If a well sample reveals only the presence of fecal streptococci and/or total coliforms, it can be interpreted to mean that surface runoff has gained access to the well. Fecal streptococci do not multiply in water; therefore their presence indicates fecal pollution with a density equal to or less than that originally present.

A summary of bacteriological results from the 1976 survey and the previous surveys is presented in Table One and the adverse bacteriological results from the 1976 survey are shown in Appendix 1.

TABLE ONE

SUMMARY OF BACTERIOLOGICAL RESULTS

FROM PRIVATE WELLS

IN THE

COMMUNITY OF PAKENHAM

Year	Satisfactory	Doubtful	Adverse	# of Samples Collected
1962 (April)	52% (16)		48% (15)	31
1962 (November)	62% (31)		38% (19)	50
1967-68 (Sept-Jan)	78% (51)		22% (14)	65
1969 (April - May)	86% (79)		14% (12)	91
1976 (June)	78% (46)	3% (2)	18% (11)	59

Satisfactory - (Total Coliform Organisms = 0)
(Fecal Coliform Organisms = 0)

Doubtful - (Total Coliform Organisms 4)
(Fecal Coliform Organisms = 0)

Adverse - (Total Coliform Organisms 4)
(Fecal Coliform Organisms - Present)
(Fecal Streptococci Organisms - Present)

Note: During the 1976 survey, fecal streptococcus examinations were made on all collected samples. These tests revealed the presence of fecal streptococcus organisms in six (6) samples where no total or fecal coliforms were found. This would mean an increase in the number of adverse samples from 11 to 17 or 29% adverse. Fecal streptococcus organisms were also found in six (6) samples where either total coliforms or fecal coliforms were present.

Discussion of Chemical Results

Thirty-one (31) random chemical samples were collected during the survey (1976). The results of the chemical analysis are presented in Appendix II.

The following is a breakdown of the occurrence and significance of the constituents commonly found in groundwater that have a significant effect on domestic use:

Nitrates - are considered non-toxic to adults; however, high levels in domestic water supplies do contribute to a condition known as infant methemoglobinemia (blue baby disease) in which the oxygen-carrying capacity of the blood is inhibited. Therefore a maximum acceptable level of 10 mg/l (milligrams per litre) as N has been established if the water is to be used for infant feeding.

The analysis for nitrate revealed none of the wells had nitrates in concentrations greater than the permissible levels and only two (2) wells with elevated nitrate levels (greater than 5 mg/l).

Chlorides - Chlorides in water generally pose no direct hazard to health. The maximum chloride concentration of 250 mg/l is recommended by the Ministry of the Environment for water supplies and is based on palatability requirements. Eight or 25% of the wells sampled had chloride present in concentrations greater than the recommended limit.

Hardness - The total hardness measures the "soap consuming power" of a water due to the presence of metallic cations. Hard waters are objectionable because they form insoluble compounds with soap. This reaction reduces the efficiency of washing procedures and increases the cost of the working process. The presence of high hardness in well waters has also been known to cause lime scale formations in plumbing fixtures. The majority of the wells sampled had hardness levels in excess of 400 mg/l which, although normal for aquifers in limestone deposits, can be considered extremely high.

Discussion of Chemical Results Cont'd.

Iron - Iron is non-toxic at high levels but objectionable in domestic supplies because of the colour and bitter taste it imparts. It is also known to cause reddish-brown stains on laundry and plumbing fixtures. The Ministry of the Environment water quality objective for iron in water supplies is 0.3 mg/l. Twelve (12) or 39% of the thirty-one chemical samples had iron present in concentrations greater than this objective.

Summary of Well Survey Results (1976)

The conclusions reached upon reviewing the foregoing information and data are summarized as follows:

(a) Sixty percent of the residences in the community of Pakenham were sampled. Upon bacteriological examination of these samples, twenty-nine percent were found to be unfit for human consumption and another three percent were in the doubtful category.

(b) There has been an apparent recent degeneration in the bacteriological groundwater quality. However, when comparing the survey times and the fact that fecal streptococcus examinations were not made on samples taken during the earlier surveys, the recent increase in the number of adverse samples may not indicate a deterioration of the groundwater quality, but may in fact more accurately reflect the actual extent, and to some degree, the cause of the well contamination problem in the community.

(c) Thirty-one residences were sampled for chemical results. In general, the analysis of these samples indicated that the water was high in alkalinity, extremely hard and had fluctuating levels of nitrates, chlorides and iron. External sources causing some localized interference would seem the most probable cause for these fluctuations.

Discussion of Chemical Results Cont'd.

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Summary of Well Survey Results (1976) Cont'd

(c) Fifteen (48%) of the wells sampled and analysed for various chemical constituents were found to have chloride and iron present in concentrations greater than the recommended limits of 250 ppm and 0.3 ppm respectively.

Surface Water & Storm Sewers

All surface waters and storm sewer outfalls in the village were sampled. The locations of stations selected in 1976-77 were predetermined by previous studies and maintained so that a comparison of results could be obtained. This comparison of sampling results is presented in Table Two.

Sampling Station A

Mississippi River - Public Bathing Area Upstream of Pakenham

The chemical and bacteriological results obtained from this sampling station can be considered normal for a river that runs through agricultural land.

Sampling Station B

Creek at Mississippi River - Downstream from Bathing Area

The bacteriological sampling results indicate that some pollutants are gaining access to this stream. The creek itself flows past the local public school. There are often children playing in the vicinity of the stream which further increases the potential health hazard.

Sampling Station C

Storm Sewer Outfall at Renfrew Street

The high BOD, suspended solids concentrations and coliforms counts found in the storm water are indicative of contaminated waters. The most probable cause would be leachate contamination from sewage disposal systems and/or direct discharge of sewage to the storm sewer.

TABLE II

VILLAGE OF PAKENHAM

SURFACE WATER & STORM SEWERS

	Site Description	Sample Date	BOD mg/l	Suspended Solids mg/l	Phosphorus mg/l	Total Nitrogen mg/l	Coliforms per 100 ml		
							Total	Fecal	Fecal Strep
A.	Mississippi River Upstream of Pakenham	Nov. 1970	2.0	5	-	-	185	12	-
		July 1972	1	5	0.034	-	-	-	-
		June 1976	2.0	<15	<.04	.90	375	68	95
		Sept. 1976	2.5	-	.016	.56	250	20	-
		May 1977	<2.0	-	.080	.62	145	14	-
B.	Creek @ Mississippi R.	June 1968	1.8	27	-	1.9	-	-	-
		Nov. 1970	2	5	0.2	-	1,500	54	-
	Downstream from Beach	July 1972	2.5	20	0.06	-	400	400	-
		June 1976	2.2	15	0.08	.56	1,700	700	1,000
		Sept. 1976	1.5	-	0.034	.48	3,300	1,820	1,100
		May 1977	<2.0	-	0.036	.27	8,400	210	-
C.	Storm Sewer Outfall at end of Renfrew St.	June 1968	5.8	18	-	3.6	-	-	-
		Nov. 1970	22	20	6.0	-	80,000+	8,000+	-
		July 1972	11.0	15	7.0	-	8,000+	8,000+	-
		June 1976	17.0	<15	2.9	2.4	8,000+	8,000+	500
		Sept. 1976	15.0	-	2.92	.29	8,000+	800+	-
		May 1977	7.0	-	-	-	80,000+	196,000	-
D.	Storm Sewer at Antrim Road Bridge	June 1968	0.8	3	-	1.9	-	-	-
		Nov. 1970	3.5	15	1.0	-	80,000	8,000	-
		July 1972	-	-	-	-	8,000	8,000	-
		June 1976	2.0	15	.24	.5	8,000	380	125
		Sept. 1976	4.0	-	.26	.55	8,000	800	-
		May 1977 *							
E.	Mississippi River at Antrim Road Bridge	June 1968	1.0	3	-	1.4	-	-	-
		Nov. 1970	2.0	5	.3	-	100	10	-
		July 1972	1	7	0.03	-	600	6	-
		June 1976	1.5	15	0.03	.4	165	20	25
		Sept. 1976	1.3	-	0.02	.35	200	20	-
	* No flow	May 1977	<2.0	-	0.022	.068	80+	30	-

Sampling Station D

Storm Sewer at Antrim Road Bridge

Similar results were found from samples collected and analyzed at this location as with the foregoing. However, with lower BOD, phosphorous and nitrogen concentrations, the contamination is of a somewhat lesser degree.

Sampling Station E

Mississippi River at Antrim Road Bridge

There has been no overall change in the chemical or bacteriological water quality at this sampling station since it was first sampled in 1968. However, even with the clear evidence of sewage contamination of the storm sewers discharging upstream of this sampling location, there appears to be no significant deterioration in the river water quality.

Conclusions

The degree of well contamination has remained relatively stable in the community since 1968 and has improved greatly when compared to the 1962 results. In 1976, twenty-nine percent of the wells sampled were found to contain water unfit for human consumption. In older communities a certain amount of well contamination can be expected and is normally attributed to old and/or faulty well construction and the resulting surface water infiltration.

The widely fluctuating concentrations of nitrates, chlorides and iron can also be attributed to surface water infiltration. These chemicals may also be present in well water from natural sources; however, when excess concentrations do occur they are normally associated with sewage effluent, road salting operations and iron reducing bacteria.

The bacteriological and chemical sample results taken in 1976 of the storm sewer outfalls indicate that sewage is gaining access to the storm sewers. The high degree of contamination seems to indicate that the pollution sources are subsurface sewage disposal systems directly connected to the storm sewers.

Conclusions Cont'd.

There have been no major changes in bacteriological or chemical sampling results of surface water and storm sewers in the community since the commencement of the surface water monitoring in 1968.

Summary

It was concluded that bacteriological water quality was improving in the community, that bacteriological contamination was a localized problem, that the chemical quality of deep aquifers and overburden aquifers is essentially the same and that the major cause of the problems in the community is poor well construction and maintenance.

Recommendations

We recommend that:

(1) Those persons whose wells have been found to be bacteriologically contaminated have them examined by a qualified person, such as a well driller or plumber, in order to ensure that surface water is not obtaining access to the well.

(2) All dug wells be sealed with an impervious material to a depth of at least eight feet in order to prevent contaminated surface water from entering the well.

(3) Those persons with bacteriologically and nitrate contaminated wells should contact the Leeds, Grenville & Lanark District Health Unit in order to ensure that their septic tank systems are not malfunctioning.

(4) Residents in the Community of Pakenham should ensure that they routinely sample their own water quality.

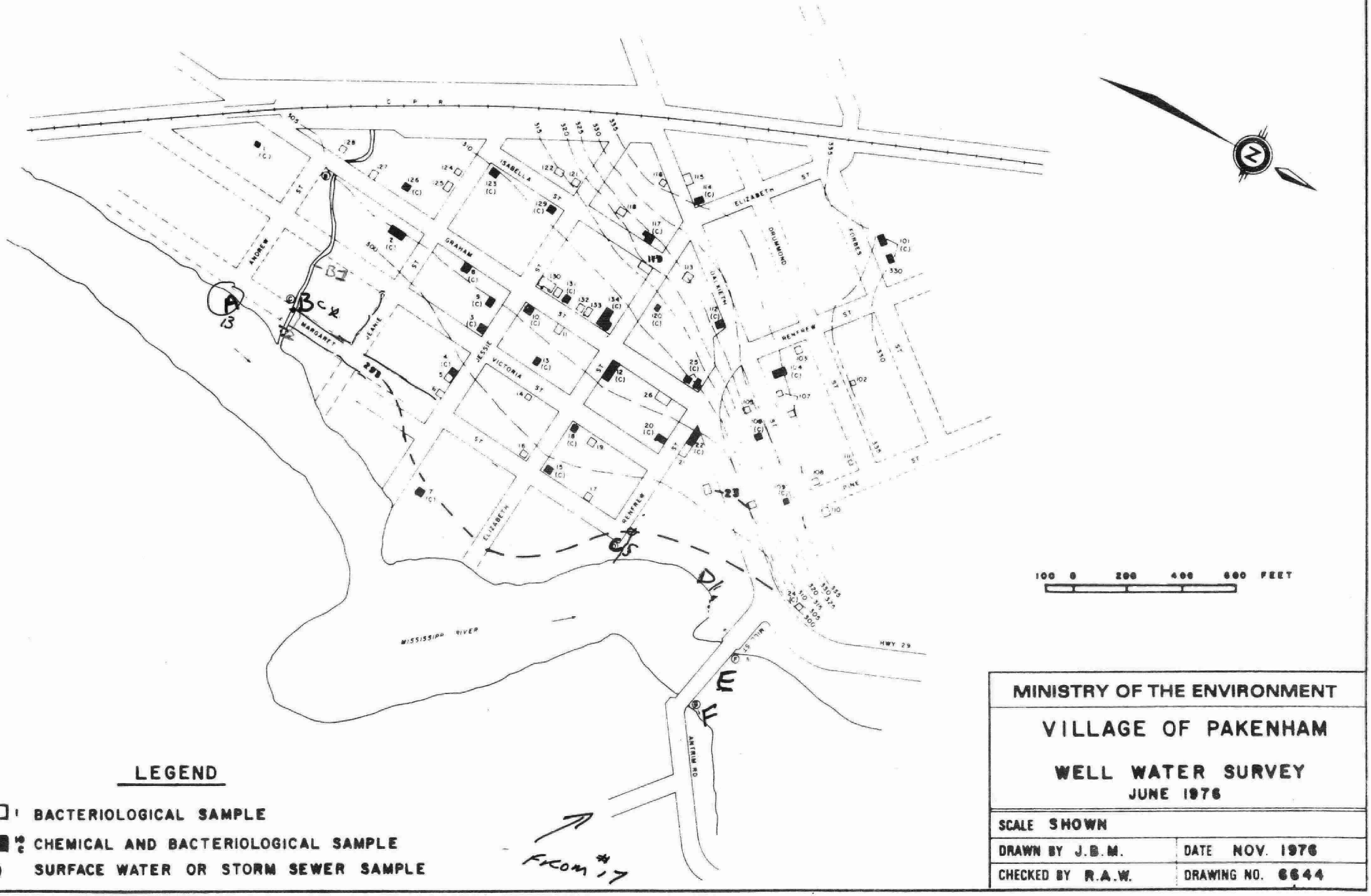
Recommendations Cont'd

(5) If a well continues to be contaminated after sealing, then the owner should contact the Leeds, Grenville & Lanark District Health Unit in order that he receive information with respect to individual disinfection methods by hypochlorinators, ozonators, ultra-violet units, etc.

(6) Those residents who are aware of problems, mal-functions with, or connections from their septic tank systems to the storm sewers, should contact the Leeds, Grenville & Lanark District Health Unit to obtain information on the abatement action required.

(7) The Leeds, Grenville & Lanark District Health Unit, with the assistance of the Ministry of the Environment, investigate all sources of sanitary waste discharges to the storm sewers and initiate any abatement action required.

(8) There is no need for a water works project in this community since the majority of the water quality problems can be corrected on an individual basis.



LEGEND

- ▭ 1 BACTERIOLOGICAL SAMPLE
- ■ 10 C CHEMICAL AND BACTERIOLOGICAL SAMPLE
- Ⓐ SURFACE WATER OR STORM SEWER SAMPLE

MINISTRY OF THE ENVIRONMENT

VILLAGE OF PAKENHAM

WELL WATER SURVEY

JUNE 1976

SCALE SHOWN	
DRAWN BY J.B.M.	DATE NOV. 1976
CHECKED BY R.A.W.	DRAWING NO. 6644

APPENDIX I

BACTERIOLOGICAL EXAMINATIONS

WELL SURVEY - JUNE 22, 1976

VILLAGE OF PAKENHAM

	Coliforms per 100 ml			
Sample No.	Total	Faecal	Streptococcus	FC/FS
25	0	0	2	<.5
3	0	0	2	<.5
106	0	0	4	<.25
132	2	0	0	-
22	2	2	0	>2
107	0	0	4	<.25
118	0	0	4	<.25
121	2	0	0	-
133	6	0	0	-
7	80+	40	0	>40
12	40	10	0	>10
4	20	0	2	<.5
108	80+	4	2	2
119	4	4	2	2
125	10	6	40	.15
117	4	2	28	.1
105	4	2	42	.1
122	0	0	42	<.1
111	80+	6	0	>6

Note: A total of 59 samples were collected during the survey. The results above are those that were considered to be adverse or doubtful. The remaining samples (not listed) were judged to be satisfactory.

APPENDIX II

CHEMICAL ANALYSIS

WELL SURVEY - JUNE 22, 1976.

VILLAGE OF PAKENHAM

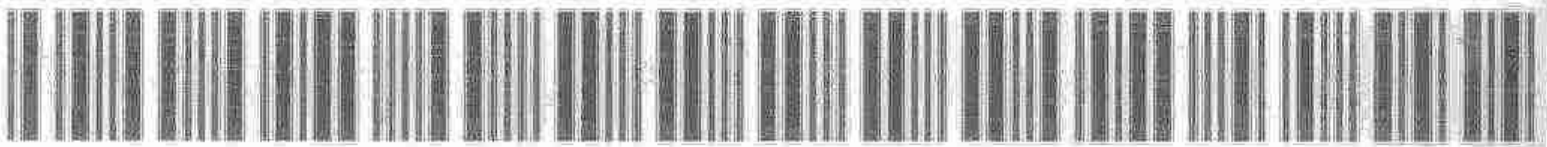
Sample No.	NO_3	Hardness as $CaCO_3$ ppm	Alkalinity as $CaCO_3$ ppm	Iron ppm	Chloride as Cl ppm	pH	Conductivity umhos/cm
13	.02	500	540	.40	210	7.5	1800
18	.34	620	430	.15	390	7.5	2700
15	.02	800	420	.60	410	7.5	3000
20	.10	230	490	.30	115	7.6	1200
* 22	.20	400	460	.10	85	7.6	1060 ✓
* 3	.14	390	500	.45	180	7.6	1600 ✓
* 4	.02	580	430	1.40	300	7.3	2600 ✓
8	.02	780	430	2.00	360	7.4	2800
* 7	.32	700	470	1.75	390	7.5	2500 ✓
2	.02	880	410	.05	500	7.6	3200
1	.12	200	510	.05	115	7.4	1300
9	.02	410	460	1.75	210	7.5	1900
10	1.2	360	550	.50	120	7.6	1300
* 25	1.7	510	540	.05	75	7.6	1000
24	.02	780	340	.70	910	7.5	3600
101	1.80	384	456	.05	56	7.8	900
104	1.88	444	452	.05	34	7.5	900
*106	5.0 -	520	460	.05	95	7.3	1000 ✓
109	2.7 -	520	490	.05	85	7.6	1000
112	.66	452	452	.05	54	7.7	920
114	.02	510	480	1.30	125	7.5	1000
*117	6.2 -	664	520	.05	158	7.4	800 ✓
120	.08	480	460	.70	115	7.4	1050
123	.12	264	496	.20	36	7.8	940
126	.60	404	360	.10	94	7.5	940
129	.14	388	452	.10	54	7.7	910
131	.02	340	530	.05	110	7.6	1550
134	.02	400	500	.95	125	7.3	1160
11	.04	410	560	7.0	125	7.5	1200
* 12	.10	250	470	.25	190	7.4	1500
14	.02	17	440	.05	270	7.5	2800

* elevated

- elevated

39% over.

26% over.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